

T03D07 – SL Periodicity Exam

Name.....

1. Which general trends are correct for the oxides of the period 3 elements (Na_2O to Cl_2O)?
- Acid character decreases.
 - Electrical conductivity (in the molten state) decreases.
 - Bonding changes from ionic to covalent.
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III
2. Which of the reactions below occur as written?
- $\text{Br}_2 + 2\text{I}^- \rightarrow 2\text{Br}^- + \text{I}_2$
 - $\text{Br}_2 + 2\text{Cl}^- \rightarrow 2\text{Br}^- + \text{Cl}_2$
- A. I only
B. II only
C. Both I and II
D. Neither I nor II
3. When the following species are arranged in order of **increasing** radius, what is the correct order?
- A. Cl^- , Ar, K^+
B. K^+ , Ar, Cl^-
C. Cl^- , K^+ , Ar
D. Ar, Cl^- , K^+
4. Which property decreases down group 7 in the periodic table?
- A. atomic radius
B. electronegativity
C. ionic radius
D. melting point
5. Which series is arranged in order of **increasing** radius?
- A. $\text{Ca}^{2+} < \text{Cl}^- < \text{K}^+$
B. $\text{K}^+ < \text{Ca}^{2+} < \text{Cl}^-$
C. $\text{Ca}^{2+} < \text{K}^+ < \text{Cl}^-$
D. $\text{Cl}^- < \text{K}^+ < \text{Ca}^{2+}$
6. What increases in **equal steps of one** from left to right in the periodic table for the elements lithium to neon?
- A. the number of occupied electron energy levels
B. the number of neutrons in the most common isotope
C. the number of electrons in the atom
D. the atomic mass
7. Which **two** elements react most vigorously with each other?
- A. chlorine and lithium
B. chlorine and potassium
C. iodine and lithium
D. iodine and potassium
8. Which properties are typical of most non-metals in period 3 (Na to Ar)?
- They form ions by gaining one or more electrons.
 - They are poor conductors of heat and electricity.
 - They have high melting points.
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III

9. Which factors lead to an element having a low value of first ionization energy?
- large atomic radius
 - high number of occupied energy levels
 - high nuclear charge
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III
10. Which statement is correct for a periodic trend?
- A. Ionization energy increases from Li to Cs.
B. Melting point increases from Li to Cs.
C. Ionization energy increases from F to I.
D. Melting point increases from F to I.
11. Which statement about electronegativity is correct?
- A. Electronegativity decreases across a period.
B. Electronegativity increases down a group.
C. Metals generally have lower electronegativity values than non-metals.
D. Noble gases have the highest electronegativity values.
12. Which compound of an element in period 3 reacts with water to form a solution with a pH greater than 7?
- A. SiO_2
B. SiCl_4
C. NaCl
D. Na_2O
13. A potassium atom has a larger atomic radius than a sodium atom. Which statement about potassium correctly explains this difference?
- A. It has a larger nuclear charge.
B. It has a lower electronegativity.
C. It has more energy levels occupied by electrons.
D. It has a lower ionization energy.
14. Which equation represents the first ionization energy of fluorine?
- A. $\text{F(g)} + \text{e}^- \rightarrow \text{F}^-(\text{g})$
B. $\text{F}^-(\text{g}) \rightarrow \text{F(g)} + \text{e}^-$
C. $\text{F}^+(\text{g}) \rightarrow \text{F(g)} + \text{e}^-$
D. $\text{F(g)} \rightarrow \text{F}^+(\text{g}) + \text{e}^-$
15. Which of the following statements are correct?
- The melting points decrease from Li \rightarrow Cs for the alkali metals.
 - The melting points increase from F \rightarrow I for the halogens.
 - The melting points decrease from Na \rightarrow Ar for the period 3 elements.
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III
16. Which oxides produce an acidic solution when added to water?
- SiO_2
 - P_4O_6
 - SO_2
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III
17. Which element is a transition metal?
- A. Ca
B. Cr
C. Ge
D. Se

- 18.** When Na, K, and Mg are arranged in **increasing** order of atomic radius (smallest first), which order is correct?
- A. Na, K, Mg
 - B. Na, Mg, K
 - C. K, Mg, Na
 - D. Mg, Na, K
- 19.** Table 6 of the Data Booklet lists melting points of the elements. Explain the trend in the melting points of the alkali metals, halogens and period 3 elements.

(Total 8 marks)

- 20.** State and explain the trends in the atomic radius and the ionization energy
- (i) for the alkali metals Li to Cs.

(4)

- (ii) for the period 3 elements Na to Cl.

(4)

(Total 8 marks)

21. (a) (i) Define the term *ionization energy*.

(2)

(ii) Write an equation, including state symbols, for the process occurring when measuring the first ionization energy of aluminum.

(1)

(b) The first ionization energies of the elements are shown in Table 7 of the Data Booklet. Explain why the first ionization energy of magnesium is greater than that of sodium.

(2)

(c) Lithium reacts with water. Write an equation for the reaction and state **two** observations that could be made during the reaction.

(3)

(Total 8 marks)

22. (a) (i) State the meaning of the term *electronegativity* and explain why the noble gases are not assigned electronegativity values.

(2)

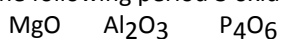
(ii) State and explain the trend in electronegativity across period 3 from Na to Cl.

(2)

(iii) Explain why Cl_2 rather than Br_2 would react more vigorously with a solution of I^- .

(2)

(b) State the acid-base properties of the following period 3 oxides.

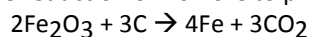


Write equations to demonstrate the acid-base properties of each compound.

(7)

(Total 13 marks)

23. The reaction below represents the reduction of iron ore to produce iron.



A mixture of 30 kg of Fe_2O_3 and 5.0 kg of C was heated until no further reaction occurred.
Calculate the maximum mass of iron that can be obtained from these masses of reactants.

(Total 5 marks)

24. The element vanadium has two isotopes, $^{50}_{23}\text{V}$ and $^{51}_{23}\text{V}$, and a relative atomic mass of 50.94.

(a) Define the term *isotope*.

(1)

(b) State the number of protons, electrons and neutrons in $^{50}_{23}\text{V}$.

(2)

(c) State and explain which is the more abundant isotope.

(1)

(d) State the name and the mass number of the isotope relative to which **all** atomic masses are measured.

(1)

(Total 5 marks)